Economic and Policy Implications – the issues

Erwin Schmid

Department of Economics and Social Sciences
University of Natural Resources and Life Sciences, Vienna

ICA Rectors and Deans Forum 2013, Ghent, Belgium, 30th – 31st October 2013

Outline

- Some Issues:
  - Issue 1: competition along & among bio-supply chains
  - Issue 2: risk management
  - Issue 3: policy intervention
  - Issue 4: integrated assessments

- Lessons learnt from the EU biofuel policy

Issue 1: Competition in each element of the bio-supply chain

- Competition for **scarce resources** (i.e. land, water, labor, capital) by food, feed, energy, chemical, and material sectors.
- Intra-sectoral competition for **biomass** (e.g. biofuels vs. power vs. chemicals vs. materials).
- Competition in **consumption** (e.g. fossil gasoline vs. biofuels).

=> increasing intensification on favorable sites and further marginalization on unfavorable sites.

=> cost of competition can be reduced by cooperation.

Issue 2: Risks along the bio-supply chains

- Many stochastic processes are involved in producing biomass (e.g. weather/climate, soil degradation, nutrient leaching).
- Volatile feedstock and commodity prices.
- Costs of production and price risks are often transmitted to final consumers (e.g. feed-in tariffs) or taxpayers (e.g. subsidies).

=> How can we share & manage the risks between the actors in the bio-supply chain? e.g. vertical integration (contracting) vs. markets vs. policy intervention.

Issue 3: Policy Intervention: Biomass Supply

- **Policy intervention** necessary to transform the economy, but usually diverging policy objectives:
  - Increasing biomass supply needs policies that foster **intensification** and **productivity**
  - Agricultural intensification may lead to **environmentally harmful outcomes**
  - Switching from **food** crops to **non-food** crops as feedstock does **not** necessarily change the **competition**.
  - Trade policies e.g. tariffs on ethanol

=> high importance of research in **sustainable land use systems** at regional to global scales.

Issue 3: Policy Intervention: Conversion Technologies (I)

- Incentive oriented policy instruments such as **carbon taxes** on fossil fuel based products **may not** foster most promising technologies.
- Tax levels required may be **inacceptable**
- These industries may therefore need additional support for
  - R&D
  - Industry network formation
  - Niche market creation

...to increase the **number of proactive actors** strengthens also the **negotiating power** of the sector (stakeholder participation)

Issue 3: Policy Intervention: Conversion Technologies (II)

- **Technology specific policies** may be necessary, but **need to be applied carefully!**
- European policy for biofuels is a rather **ineffective way of promoting biomass** in the energy sector:
  - is expensive in comparison to other biomass conversion chains,
  - has a lower total potential of substituting fossil fuels.
- Research in **integrated assessments** of current and future biomass conversion chains is crucial to understand which policies may deliver the desired outcome, although **uncertainties remain high** in any case.

Issue 4: Integrated Assessments: Technical vs. economic potentials

- **Bio-physical/technical potential** = most productive crops/plants and technologies that convert natural resources into biomass.
- **Economic potential** = benefits and costs of production and consumption (market and non-market benefits as well as direct, opportunity, transaction, and external costs).
- The economic potential is usually much **lower** than the technical.
- Experiences with **biogas plants & biomass combined heat and power** and **ethanol plants** in Austria show that economic assumptions on feedstock costs were often too optimistic => many operators in trouble.

Issue 4: Integrated assessments: Energy vs. chemicals

- Biomass **important source of renewable energy production** (10% globally) and highly important for achieving renewable energy targets.
- Considering fossil fuel depletion, **no alternatives to biomass in producing chemicals** in the long run.
- A proper way of using biomass in the two sectors therefore **depends on assumptions** about:

    climate change impacts and fossil fuel depletion.

Issue 4: Integrated Assessments: Energy vs. chemicals (II)

- Very high uncertainties are attached to all future scenarios concerning these assumptions. But,
  - Energy and chemical uses are only **partly competing**.
  - Competition can be lowered if **cascade utilization of biomass is intensified.**
- Historically, petrochemical industries have developed from **fuel producers** to **providers** of all sort of chemicals. Similar development for biorefineries?

Trade-offs and synergies need to be made visible => integrated assessments

Lessons learnt from 10+ years of EU biofuel policy

Lessons learnt - Policies (I)

- Major policy objectives i.e. reducing GHG emissions and substituting fossil fuels.
- => ambitious policy targets e.g. EU 20/20/20 i.e. burden sharing among Member States.
- => implementation of a mix of policy instruments e.g. subsidies, taxes, blending rates, feed-in tariffs, import tariffs.
  - merits of instruments are very different.
- Major consequences: in/direct land use change, carbon leakage, rebound effect.

Lessons learnt – Policies (II)

- **Sustainability Criteria: EU Renewable Energy Directive (RED, 2009)**
  - *Article 17.2:* *With effect from 1st January 2017, the* ***GHG emission saving*** *from the use of biofuels and bioliquids shall be* ***at least 50%****;*
  - *Article 17.3:* *Biofuels and bioliquids shall not be made from raw material obtained from land with high biodiversity value namely primary forests and other wooded land, areas designated or* ***highly biodiverse grassland****;*
  - *Article 17.4:* *Biofuels and bioliquids shall not be made from raw material obtained from land with* ***high carbon stock*** *namely wetlands and continuously forested areas;*

Integrated Global Impact Assessment

- EU biofuel demand could be satisfied „sustainable“, **if reallocated from sectors without sustainability criteria**.
- RED drives losses of 2.2 Mha of highly biodiverse areas generating additional 95 Mt CO2 eq.
- => to be effective: policy needs to be more complete in targeting a wider scope of bio-based commodities and more comprehensive in the membership of countries.

Frank S., H. Böttcher, P. Havlik, H. Valin, A. Mosnier, M. Obersteiner, E. Schmid, and B. Elbersen (2013) How effective are sustainability criteria accompaying the European Union 2020 biofuel targets? *GCB Bioenergy*, **5(3)**, 306-314

Lesson learnt - Regionalization and biomass logistics (I)

- Energy density of fossil fuels (~13 MWh t^{-1}) higher than that of biomass (~4.5 MWh t^{-1}).
- Transportation in pipelines is impossible => transportation costs of biomass higher.
- Size of biorefineries and bioenergy plants are mainly determined by two factors:
  - Increasing biorefinery size causes **larger transportation distances** for biomass and therefore higher costs.
  - Increasing biorefinery size causes **decreasing investment costs per unit** (economies of scale).

Lesson learnt - Regionalization and biomass logistics (II)

- Optimal size of **biorefineries** smaller than **fossil refineries.**
- Low-cost **transportation corridors** like rivers and harbors **do** have an influence on the location of biorefineries.
- Reducing **transportation costs,** exploiting **economies of scale,** and **utilize** all **biomass compounds** and **co-products** is key to guarantee economic feasibility
  - pre-treatment of biomass (pelletisation, compression, liquidification)
  - cascade processing in larger centralized units
  - Intermediate and final products (utilize all bio-co-products e.g. heat)

=> increasing trade of biomass & bio-based products => international feedbacks (e.g. iLUC, carbon leakage)!

Biomass logistics is key

Nature Works LLC biopolymer production (US):
capacity 308.000 t of biomass (3.1% of full scale fossil fuel refinery)

Image:Google Earth

Alholmens Kraft Ab (Finland):
Biggest bioenergy plant in the world
550 MW capacity (10% of biggest coal plant)

Image:Google Earth

Major lesson learnt

- **Exploration of fossil fuels:** economic advantages over renewable resources, but huge external costs e.g. climate change.
- **High uncertainty** about **fossil fuel depletion** and **climate change impacts:** how can we provide sufficient *food, fibre, feed, energy, chemicals and materials* to our societies in the future?
- **Economy transition:** bio-based economies => non-renewable based economies => **renewable based economies** and **bioeconomy** is a part of.